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BEFORE THE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD

CENTRAL VALLEY REGION

In the Matter of Hilmar Cheese Company, Inc., and Hilmar Whey Protein, Inc. (Merced County)	Administrative Civil Liability Complaint No. R5-2005-0501

PREPARED DIRECT TESTIMONY OF TEDD STRUCKMEYER AND WARREN CLIMO IN SUPPORT OF HILMAR CHEESE COMPANY, INC., AND HILMAR WHEY PROTEIN, INC.

1.0 Introduction

The following is prepared direct testimony by Tedd Struckmeyer and Warren Climo, employees of Hilmar Cheese Company (HCC), relating to the history of wastewater treatment at the company's Lander Avenue processing facility. Mr. Struckmeyer is Vice President of Engineering and Business Development at HCC, while Mr. Climo is HCC's Director – Environmental Management.

This testimony addresses a number of the factors in Water Code Section 13327 that the Central Valley Regional Water Quality Control Board (CVRWQB) is required to consider in determining the amount of civil liability, if any, to impose on HCC in this administrative civil liability (ACL) proceeding, including the nature and circumstances of the discharge in question, and the degree of culpability of the discharger. This testimony is based upon Mr. Struckmeyer's and Mr. Climo's recollections, to the best of their abilities, of events, issues and documents relating to the treatment of wastewater on-site at HCC.

2.0 Summary of Testimony

This testimony demonstrates (1) that HCC has fully cooperated with CVRWQCB staff in an attempt to meet the unprecedented discharge limit for electrical conductivity (EC) of 900 μmhos/cm in HCC's 1997 Waste Discharge Requirements (WDRs or permit), (2) that HCC has made every reasonable effort in its innovative attempts to meet this limit, and (3) that HCC cannot fairly be considered - in hindsight - to be culpable for not having been able to meet this unachievable limit. Among other things, this testimony additionally shows:

- The EC discharge limit in HCC's 1997 permit should not have been imposed on HCC in the first instance and has proven to be unachievable. This limit resulted in the company being required to discharge water at lower salinity levels than it had in its potable water supply. At the current state of research and development (R&D), there is no proven, reliable technology to treat dairy industry wastewater to the permit standard that is economically and environmentally sustainable.

- HCC has made every effort to meet the EC limit in its permit, including expending over $85 million in an attempt to do so. An extraordinary cost in human resources also has been paid in terms of man-hours and the stress of trying to achieve the unachievable in a very short time frame for this type of R&D.
- The most recent (2003) California Department of Food & Agriculture cost study of Cheddar Cheese Plants indicates that HCC's cost of wastewater treatment is three times greater than the average of other plants – and our costs have dramatically increased since then.
- The CVRWQCB forced the choice of membrane mineral removal on HCC through the imposition of the 900 μmhos/cm EC limit at "point of discharge." Consideration was not given to accepted land based treatments, a mixing zone or natural attenuation. Nor were any studies undertaken by regulators to ascertain the technical feasibility and economic impacts of such a permit condition.
- The ACL complaint ignores HCC's hard-earned contribution to the State's knowledge of waste minimization, clean production, and concomitant salinity control.
- It is now being recognized by regulators and industry that the treatment path mandated by HCC's 1997 permit – namely, reverse osmosis (RO) - is seriously flawed *(State Water Resources Control Board Workshop – July 11th 2005)*. A best practicable treatment and/or control evaluation has not been conducted to verify that the required mineral removal processes for industrial wastewater are practical, economic, achievable and environmental sustainable.
- HCC, through its cooperation and desire to do the right thing, has been penalized thrice – firstly by the cost and efforts on our yet unsuccessful attempt to make RO work, secondly by the proposed ACL, and thirdly by the damage to the company's goodwill through inaccurate accusations uninformed by all of the facts.

- Under these circumstances, the proposed ACL is grossly excessive and should be significantly reduced, if any penalty is imposed at all.

3.0 HCC Background

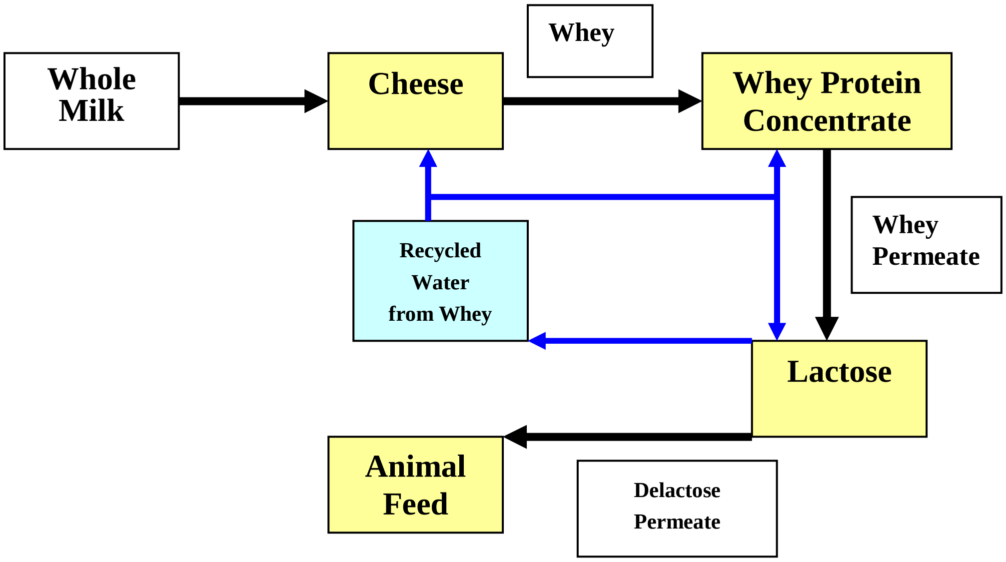
The Hilmar Cheese Company is a privately held corporation established in 1984 by 12 local Jersey dairy families who had a vision to provide more value from the milk they produce. Since its beginnings, the company has grown from a small cheese making operation to a large integrated operation which converts the milk stream it receives into saleable products – cheese, whey protein concentrate, lactose and liquid animal feed (see Figure 1 below).

HCC has achieved this success by being an innovator utilizing new technologies to improve plant efficiencies and make new products. It has often taken on the application of new technologies that have not been historically proven for the HCC production profile. When possible, the company has perfected the application of many technologies through hard work, focus and commitment, and in most circumstances, has successfully implemented these advanced technologies. This innovative and action oriented culture has enabled HCC to grow for the benefit of its owners, dairymen milk suppliers, other suppliers, customers, the local community and the community at large.

Within its processing facility, HCC has focused on minimizing resource use through the development of clean production and waste minimization practices. Most importantly, HCC has developed sophisticated water and cleaning in place (CIP) chemical recycling processes. This has enabled the company to reduce its reliance on groundwater supplies by approximately 1,000,000 gallons of water per day. In conjunction with this reduction in reliance on groundwater, the company has also recycled cleaning chemicals thereby reducing the importation of otherwise "use-once and dispose" chemicals.

HCC currently employs over 600 people providing well-paid and worthwhile jobs to a region that has often struggled to maintain such businesses. It is now an integral and significant part of the local commercial and social structure.

Figure 1: Flow chart of basic milk processing at HCC's site



4.0 Summary of the History of Wastewater Treatment at the HCC Site

4.1 **1985 – 1991**: During the early years of HCC's operation, permits from Merced County's Department of Environmental Health and then the CVRWQCB covered the wastewater discharge from the facility. Land-based application and treatment of waste flows, as advocated by EPA, was initially used at the facility. The initial outputs from the facility included cleaning wastes. Whey from the cheese making process was used as an animal feed at dairies.

4.2 **1992 – 1996**: As the company grew, whey processing was added in 1992 to produce whey protein concentrate. The concentrated lactose permeate was used at local dairy operations. In 1994, a lactose processing facility was built to process permeate from the whey protein concentrate process with the by-product, delactose permeate, being used at dairies as feed. During this time, the CVRWQCB began indicating a need for additional wastewater treatment and included control of mineral discharges as a necessary part of treatment. HCC initiated recycling of acidic and caustic waste streams within the facility. In many circumstances, acids and caustic materials were captured and reused. After this reuse, the spent acid was collected by a soil amendment manufacturer and the spent caustic material was sent to the City of Merced's POTW.

4.3 **1997 – 2002:** As the CVRWQCB requirements moved to prevent the use of land based treatment systems (1997 permit conditions), HCC, in order to achieve discharge requirements, researched, trialed, and installed various membrane separation processes on wastewater streams. The membranes included variations of nanofiltraton (NF), ultrafiltration (UF), and reverse osmosis (RO) in conjunction with land-based polishing and disposal. Acid and caustic recycling/reclaim continued. This was a significant R&D investment as numerous processing difficulties were encountered with membranes fouling and scaling. These difficulties are still not fully resolved. Based upon the treatment of 65% of the flow through membrane treatment and blending the remaining 35% prior to discharge to an increased land area, an ROWD was submitted to CVRWQCB in April 2000 for a monthly average flow of 1.25 mgd.

Following a threat by CVRWQCB staff to include organic limits in the WDRs (letter dated June 2000 from S. Patterson), HCC could not blend as proposed and increased treatment capacity to process all the wastewater flow. The full system was implemented by December 2000. A new ROWD was submitted in February 2001 based upon an increase in treatment to 100% of flow through membranes with RO permeate to secondary lands and a total monthly average discharge of 1.5 mgd. Through 2001, difficulties in processing all the wastewater were faced and efforts were focused upon trying to resolve these issues.

4.4 **2002 – 2004:** During the early part of 2002 it was recognized that the full membrane treatment system would not work. Alternatives were sought. The membrane treatment systems were changed to include Physico-Chemical Dissolved Air Floatation (PCDAF) to remove suspended solids, followed by partial RO and land-based application. Acid and caustic recycling continued, but spent caustic was retained within the wastewater process as the Merced POTW could no longer take the material into their facility. Design and construction of an advanced biological treatment process also was initiated. In March 2003, the proposed plan to treat the wastewater with advanced biological systems was presented to CVRWQCB staff. This was formalized into a defined plan in submissions presented in September 2003 in response to an NOV.

4.5 **September 2004 – April 2005:** The new biological treatment process, including PCDAF, anaerobic digestion and aerobic polishing, was commissioned to remove the majority of the organic load from the wastewater. Reverse osmosis on some of the outflow was combined with land-based polishing and disposal of the treated wastewater. R&D continued. Trials were initiated to run more treated wastewater through reverse osmosis using ultrafiltration to remove residual microbial mass prior to the ROs. Research was also conducted to try to reduce scaling on membranes. A new ROWD was submitted to CVRWQCB staff in August 2004 for a monthly average discharge of 2.0 mgd. This was based upon a three phased approach: use of biological treatment and RO in the short term; biological treatment followed by irrigation of mineral load to other lands in phase 2; and deep well injection of minerals in a third option.

4.6 **April 2005 - Present:** Ultrafiltration units were added to the process after initial success at pilot scale. PCDAF, anaerobic digestion, aerobic polishing, partial ultrafiltration, partial reverse osmosis and land-based polishing and disposal formed the process. Scaling of membranes is still prevalent. Severe fouling of UF membranes was encountered as attempts were made to reduce mineral scaling on the RO membranes.

4.7 **Present to Future:** We are continuing our attempts to run higher levels of treated wastewater through UF and RO and to fine-tune the PCDAF system to reduce mineral impacts on membranes. In addition, we are exploring options to not process treated water through RO and to seek a determination that our discharge is "reclaimed" water. Additionally, we are developing plans to distribute treated water to a large area, mixed with Turlock Irrigation District (TID) canal water, and are exploring potential use of deep well injection as an alternative outlet for minerals.

5.0 CVRWQCB Forces Change Away From Land Application

In 1994 the CVRWQCB, under Order No. 94-276, signaled a future requirement for a 900 µmhos/cm EC "end of pipe" discharge limit. At this time, no indication was given for an organic content limit. This was the first formal indication that the CVRWQCB wanted to limit mineral discharges to land.

This permit gave no allowance for land treatment, a mixing zone or natural attenuation in groundwaters under the site. It required discharge wastewater to meet the lower end of the drinking water standard for EC at the point of discharge. In other words, it required HCC to reduce the EC in its discharge at the "end of pipe" to an EC level lower than community water systems are allowed to provide as drinking water to their customers. This was a significant change in the regulatory approach in terms of the standards to be met and the point of compliance.

HCC, in good faith, undertook an external study of technology-based solutions (reverse osmosis (RO), electro dialysis (ED), distillation, and ion exchange (IX)), to meet this requirement. This study, conducted by Nolte and Associates, reviewed these technologies in terms of their capabilities to treat wastewater to the required standards.

The conclusion of this study, embodied in a technical report to the CVRWQCB, was that of the technologies available at that time, only RO had the potential to remove minerals to meet the 900 µmhos/cm EC limit. However, the report also indicated that RO was not viable due to expense ($7.30/1000 gals. - without brine disposal costs) and there was *no suitable brine outlet*.

Based on the infeasibility of this technology-based approach, HCC proposed land-based treatment to the CVRWQCB staff in line with widely accepted land treatment practices. Despite the findings of the technical report from certified experts, CVRWQCB staff did not accept the report's findings and maintained their position in requiring HCC to meet the 900 µmhos/cm EC end of pipe discharge limit. This decision gave HCC no alternative but to try the use of mineral separation technology (RO or a similar process) in spite of expert advice to the contrary. There was no other way to attempt to reduce minerals to the levels required nor was there any guidance to draw on from an implementation plan associated with the Basin Plan, since none had been done.

6.0 1995 – Source Control & Recycling Efforts

While the review of a technology-based solution was being undertaken, HCC and Nolte undertook a study to look at how to reduce mineral discharges in HCC's wastewater by the use of source control and recycling. The aim of this study was to determine how low the EC of the discharged wastewater could reasonably be reduced and to link this to a land based polishing and discharge system.

Prior to this study, the EC in HCC's discharge averaged 2500 µmhos/cm. Along with fine-tuning the use of cleaning chemicals within the plants to minimize usage, the acid and caustic rinse waters were reclaimed in a separate system. The acid and caustic rinse waters were then cleaned using nanofiltration on ceramic membranes and reused for initial washes in other parts of the plant. After this, they were shipped off-site for further treatment at a POTW (Merced for caustic materials) or used as a base ingredient for a soil amendment (for acid materials).

Through these trials, reductions in EC were achieved with a low of 1300 and an average of 1600 E.C. (within the range for EC that community water systems are allowed to serve as drinking water to their customers). The extent of this work, and subsequent adoption of such practices, has been recognized by CVRWQCB staff- "*HCC segregated brines and acids, and implemented housekeeping remedies, in the mid-1990s*"**.** *ACL Staff Report, Page 12.*

UC Davis mirrored HCC and Nolte's results in a recent study (September 2004) of dairy plants discharging into the City of Tulare POTW. In the UC Davis study they found that, using best practices, it was difficult to reduce wastewater salinity to less than 500 µmhos/cm above the incoming water quality (personal communication with Dr. Jatal D. Mannapperuma). When this is related to HCC's circumstances with incoming potable water at about 950 µmhos/cm, the <u>best</u> that could reasonably be achieved under these criteria was 1450 µmhos/cm in the wastewater discharge.

The HCC and Nolte study was then used as a basis for submitting a revised wastewater plan that included source control, recycling and land based treatment of wastewater *(Revised Wastewater Management Plan, Oct 16th, 1995).*

A revised plan was submitted to CVRWQCB staff in 1996 based on land application of wastewater, followed by periods of cropping using TID irrigation water. Again, CVRWQCB staff did not accept this approach, but maintained the requirement for an end of pipe 900 µmhos/cm EC discharge with no allowance for land based treatment, natural attenuation or mixing. This limit is at the lower end of the primary MCL for the supply of drinking water to the public.

7.0 1997 – New Permit and Challenges

7.1 CVRWQCB Issue A New Permit

The CVRWQCB issued a new permit in 1997 for a 750,000 gpd discharge requiring HCC to meet a 900 µmhos/cm EC end of pipe discharge limit and to comply by March 1999. This permit did not include an organic limit in the discharge. At this time, HCC's incoming potable water had an EC of approximately 950 µmhos/cm. Again there was no allowance given for land treatment, a mixing zone or natural attenuation in groundwater.

HCC could have appealed this permit but this was contrary to its normal practice of seeking to be an innovator. The company did not appeal and instead sought to cooperate and develop the means of making its wastewater cleaner than its incoming potable water through the use of membrane separation technologies.

This technological approach required innovation and risk as it had not been done before on dairy industry wastewaters that could be considered as a reasonable homologue to HCC's wastewater, nor was there a suitable outlet for any removed and concentrated minerals. This work was only undertaken with the knowledge that CVRWQCB staff supported the innovative approaches needed to resolve the salinity issue. The task was unprecedented and no one else had been asked to do this, nor had it been done before.

The problems faced by HCC were recognized by CVRWQCB staff in the ACL Staff Report in April 2005. Staff noted: *"An inability to comply with the EC limit was, at least in part, due to solving technological problems that others have not yet been required, or only more recently required to address." ACL Staff Report, Page 12.*

7.2 HCC Takes Up the Challenge

The decision to proceed with trying to comply with the 1997 permit was supported by the prevailing culture within the company. HCC had a long record of compliance with regulators – this included meeting prevailing food-processing requirements with CDFA and USDA, labor relations, and occupational health and safety (Cal OSHA). The company was innovative in taking on new technologies, ironing out operational difficulties, and making things work in practice. It also had extensive experience with membranes through the use of whey ultrafiltration and reverse osmosis and evaporation of permeate that resulted in the reuse of production water from reclaimed cow water.

7.3 Trying to Get to 900 µmhos/cm EC in the Discharge

The challenges faced when trying to get the discharge salinity below the incoming potable water supply were complex. Firstly, the treatment system needed to be able to remove minerals from a wastewater stream that was variable and complicated with organic residues of milk. The organic fraction would have to be removed, at least in part, to be able to remove the minerals. In addition, due to the recycling of water at the plant, the wastewater was more concentrated than a "one pass" wastewater, which further complicated the problems associated with sustainable mineral removal.

Once minerals and organics were removed, an acceptable outlet for them had to be established – acceptable being taken to mean an outlet that was practical, economic and met regulatory requirements.

Based on the initial studies by Nolte, which demonstrated very poor economics, any removal systems would need to have improved performance to be successful. Overall sustainability would also need to be considered, as any treatment process should not cause other environmental problems.

From consideration of these factors, a conceptual process was devised that removed minerals and organics in various streams that could then be converted to saleable products, thereby recycling the wastes, reducing treatment costs to acceptable levels, and meeting CVRWQCB requirements. The process required the use of membrane separation systems to remove the various constituents, leaving water of less than 900 µmhos/cm EC for beneficial irrigation to land. Market research and development was also required to ascertain the viability of these new products.

7.4 **V-SEP® – Vibrating Membranes**

HCC had begun its search for appropriate membrane technology in 1996. During this search, a relatively new vibrating membrane process was found that had a number of positive attributes. These membranes (VSeps) were provided by New Logic and appeared to be well suited to the types of mineral and organic constituents found in HCC's wastewater.

Based on the presentations by New Logic, pilot trials were conducted from October 1996 to April 1997 using nanofiltraton (NF) membranes in VSep units. These trials were performed on wastewater from the cheese pit – this wastewater contained the majority of the fat and protein residues of the process and was about 2/3 of the total wastewater flow. The trials were successful at this pilot scale.

CVRWQCB staff were kept informed of the trial data and were supportive of the progress made - *"Based upon the favorable results of the pilot studies, Regional Board staff supported the use of the VSep system and was optimistic that HCC would soon be able to operate in compliance with applicable orders." ACL Staff Report, Page 4.* With this support in place, HCC made the decision in April 1997 to scale up to a full system. This full system included 7 VSep units with fitted NF membranes. The plan at this stage was to blend the treated outflow from the cheese pit with the remaining wastewater flow from the lactose pit to get to the limit of 900 µmhos/cm EC. A key factor in the plan was to make a nutrient rich animal feed product from the retained solids, thereby creating a marketable product from what was once considered a waste. This also provided an acceptable recycling outlet for the minerals.

8.0 1998 – The VSep System Is Implemented

During the latter part of 1997 and early 1998, the 7 unit VSep system was designed and installed. In June 1998 the system was commissioned using the nanofiltration membranes that were successfully used in the pilot trial.

The VSeps did not function properly at full scale. They failed to match the pilot trial performance and could not process at the design feed rates due to rapid fouling from mineral, organic and bacteriological loads. Frequent cleaning was required which reduced run time and added to total loads requiring treatment.

For the remainder of 1998 and into early 1999, new trials were initiated using several different types and combinations of membranes in the VSep units – reverse osmosis (RO), ultrafiltration (UF) and microfiltration (MF).

9.0 1999 to 2000 - Adding To The VSep System

9.1 Installation of New Units and Membranes

After reviewing the trials of various membrane types and combinations, in October 1999 HCC installed 6 additional VSeps units and changed the membrane system to have 7 units with UF and 6 with RO membranes. These were set up in series with the UF units at the start of the process to remove fats and proteins in the retentate, while the permeate from these units was run through the RO units to remove lactose and minerals. The whole system was designed to only treat the flow coming from the cheese pit, since the plan remained to blend the treated flow with the remaining wastewater flow from the lactose pit to get to the limit of 900 µmhos/cm EC.

The removed fats and proteins were further processed and ultimately blended with other ingredients to produce a new calf feed product. The lactose and minerals rich retentate from the RO units was blended with animal feed. The clean permeate from the RO units was then blended with the flow from the lactose pit and discharged to the primary fields for land based treatment.

9.2 Submission of a New ROWD

Based on the early performance of the combined UF / RO VSep system, HCC submitted in April 2000 a new ROWD to the CVRWQCB, including a provision for an increase in the monthly average volume of discharge to 1.25 mgd.

After, initial comments from the CVRWQCB staff, a revised Wastewater Management Plan was submitted to the CVRWQCB in June 2000. Following this, the CVRWQCB staff came back with a new requirement to lower the level of organics being discharged to the fields. This was a significant change in the approach adopted by the CVRWQCB staff and was a crucial factor in HCC's not being able to technically achieve the 900 µmhos/cm EC limits utilizing the approach HCC had been following to that time.

HCC could have challenged this new requirement, which was outside the permit process, but again did not. The significance of this change was not known at the time. It was wrongly assumed that to meet the new requirement all HCC had to do was increase the size of the VSep system. This proved to be a technically flawed assumption, as the composition of the previously untreated, low suspended solids lactose pit water caused a range of problems that were partly to blame both for the failure of the VSep system (low pH conditions causing flux deterioration) and for the inability to process wastewater through reverse osmosis to remove minerals (excessive fouling and scaling).

However, based upon the assumption that only an increase in the size of the VSep system was required, HCC again planned to expand to 13 VSeps as UFs and coupled that in a series to a large, spiral wound cross-flow RO. In conjunction with this expansion, trials began to run all the wastewater (cheese pit plus lactose pit streams) through the process.

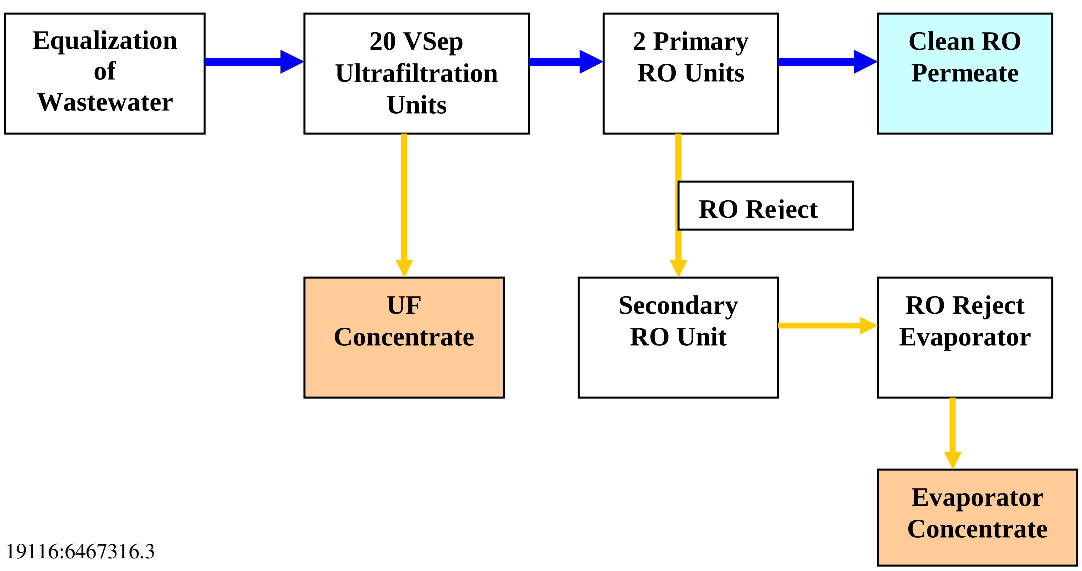
10.0 2001 - The Final Set Up of the VSep System

From the initial work with trying to include the lactose pit into the VSep treatment system, it became apparent that the flux rates /flow through the membranes was dramatically reduced at anything other than alkaline pHs. The lactose pit, being generally acidic in nature, decreased these flux rates/flow to such an extent that more capacity was needed.

In addition, with the extra mineral and lactose load being extracted from the lactose pit stream, the volume of brine rose to levels that could no longer be tolerated in the animal feed due to excess salt levels. This then demanded that the brine be concentrated further and removed from the site.

Further expansions of the treatment system were undertaken to treat these increased demands. In July 2001, an extra 7 VSeps (with UF membranes), a second large primary RO, another RO to further concentrate primary RO reject, and a RO reject evaporator were installed (see Figure 2 below). This was the final configuration for this treatment system and received support from the CVRWQCB Executive Officer for the advancements made - *"I was favorably impressed with the efforts Hilmar has undertaken to improve wastewater management practices at the facility." "I want to also acknowledge the level of effort that you and your staff have expended to bring your waste treatment and disposal operation to its current status." January 2002 letter from CVRWQCB Executive Officer to HCC.*

Figure 2: Final configuration of the VSep and RO treatment system



Through the commissioning phases RO concentrate was produced from various trials and stages of the system as it was built. A letter from CVRWQCB staff was received on October 31, 2000 that declared RO concentrate as a designated waste. In January 2001, when the ROs began to produce very clean permeate on a regular basis, some RO concentrate was applied to the primary lands. An NOV was received from CVRWQCB staff on March 20, 2001 for this action. HCC had not fully comprehend the ramifications of applying this RO concentrate to the primary land as it contained the same constituents that had previously been applied to it. In response to the NOV, HCC took steps to remove the RO concentrate from the site. This issue highlighted the difficulty of dealing with the RO concentrate material and finding appropriate disposal outlets. Discharge of RO concentrate to the primary fields ceased on August 1, 2001, when the new RO concentrate evaporator started operating. As a result, except on a few occasions when the RO concentrate evaporator has experienced mechanical issues, no RO concentrate has been discharged to the primary fields since that time.

11.0 2002 - The Unforeseen Problems

Through 2001 and early 2002, the treatment success through the enlarged and upgraded treatment system began to show signs of failure. The most obvious problem was that the VSep units could not run at flux rates high enough to process all the wastewater. This was especially apparent at low pH levels. To get reasonable flux rates the pH had to be near pH 11.

In combination with the poor flux rates through the VSep units, there was heavy organic fouling and mineral scaling on the RO units. This was worse when attempts were made to run the lactose pit water through the system. This caused both low fluxes in the VSeps and increased scaling in the ROs. To keep the VSep flux rates up, they required frequent cleaning. This wastewater membrane cleaning added significant chemical loads to the treatment system and lowered the total volume of wastewater that could be processed due to the ever increasing cleaning times required for the attempts to rejuvenate the flux rates. The RO membranes required cleaning at least every 20 hours.

The UF membranes within the VSep units began to physically break down well before the predicted 5-year life expectancy. Parts of the membranes began to be collected on the RO pre-filters indicating serious failure. In addition, the VSeps also suffered excessive mechanical failure and required high maintenance. The vibratory shear motion put a lot of strain on the moving parts and, most likely, on the membranes within each unit. With breakdown occurring within 12 months of operation the technical and economic sustainability of the units was compromised.

The organic fouling of the RO membranes was thought to be due to the failure of the VSep membranes to remove all the fats and proteinaceous compounds from the waste stream. The UF membranes within each "stack" began to fail causing more leakage. In addition, at the high operational pH levels needed to attempt to achieve the design flux rates, the membrane porosity increased due to the chemical make up of the membranes and consequently leaked more wastewater components to the ROs. This, in turn, caused deterioration in the RO performance.

To complicate matters even further, the VSep supplier, New Logic, had commercial difficulties and was forced into Chapter 11 proceedings. After New Logic had exited bankruptcy, there was a large shift in the costs of replacement of the proprietary VSep membrane units from approximately $50,000 per unit to over $80,000 for each VSep. The calf milk replacer trials also failed due to poor bioavailability of the components extracted from the wastewater.

The reason for the scaling on the RO membranes is very complicated and some of the information is under supplier / customer confidentiality. However in general, the problems with scaling relate to the concentrated nature and composition of the wastewaters and the need to concentrate the retained mineral stream to ship it off-site. At the mineral concentrations encountered in this process, precipitation occurred on the membranes causing severe scaling, reductions in flux, increased cleaning and loss of membrane life.

It proved impossible to run the lactose pit water stream through the units as they immediately showed dramatic flux reductions and scaling as soon as this wastewater sream was introduced to the process stream. This meant that, regardless of the total flow or size of reverse osmosis equipment installed, only a proportion of the wastewater could be processed. Of the flow that could be processed, the fouling and scaling problems and concomitant ”ever-escalating” chemical cleaning were becoming impractical to process. This meant that HCC could not solve the problem by reducing milk intake to the plant as there was always a portion of the wastewater that could not be processed. For this reason, HCC’s plant expansions did not affect its ability to meet the EC limit – there still would have been a portion of the wastewater that could not be processed, and therefore would not have met the limit, even had HCC not expanded.

A number of particular minerals appear to cause scaling problems. Silica at levels above 20 mg/L is known to cause RO membrane fouling. The potable water supplies for HCC are typically over 50 mg/L and during the membrane processing of wastewater, concentration levels at the membrane surfaces would reach higher levels through the phenomenon known as concentration polarization at the membrane surface.

Magnesium and calcium occur at significant levels in dairy wastewater. These divalent cations combine with phosphates, silicates, sulfates and bicarbonates to form precipitates that are difficult to near impossible to remove from membrane surfaces and/or the subsequent evaporation process. This troublesome chemistry is generally known as scaling.

Control of this mineral scaling has proven to be extremely difficult. Antiscalants have been tried but with very limited success. Cleaning regimes have been trialed using a range of cleaning agents – but again the success is very limited. The result of this level of fouling and scaling, along with the damage to membranes caused by excessive cleaning, is that the membrane life has been reduced to 4 – 6 months. Some membranes have failed within weeks.

The company finally came to the conclusion that this treatment scenario was not going to work in the long run and began looking for alternatives. It should be noted that from the time that HCC submitted its ROWD in February 2001 (for an increase in the discharge flow to a monthly average of 1.5 million gallons per day) through the end of the ACL period in November 2004, the monthly average wastewater flow to the primary lands was 789,000 gallons per day and the total wastewater flow (to the primary and secondary lands combined) was 1.42 million gallons per day (within the reported increase).

12.0 2002 - Alternatives Sought

With the increasing costs and lack of progress in fully treating HCC's wastewater to the required standards, HCC began to explore other treatment options, with the knowledge and support of CVRWQCB staff. This included initiating dialogue with the City of Turlock's Regional POTW facility to treat a proportion of the flow. In addition, an exploration was undertaken of options to treat on-site in some other fashion. To explore on-site options, an internationally experienced food processing wastewater specialist from Launch Technologies Ltd. was engaged to review the current treatment system and advise on alternatives.

In recognition of the fact that it would take time for HCC to implement an alternative approach, CVRWQCB staff proposed, in early January 2002, to issue to HCC *within the next few months* updated WDRs that would include a time schedule. *(See January 2002 letter from CVRWQCB Executive Officer to HCC).* In good faith reliance on this representation, HCC proceeded to explore alternative approaches and to provide CVRWQCB staff with a time schedule for implementation of the alternative ultimately selected. CVRWQCB staff never responded to the timetable HCC proposed, which HCC understood to mean that the timetable was acceptable to staff. As we understand staff has acknowledged in deposition, had staff provided HCC with a time schedule, there would have been no basis for the current ACL which reaches back to January 2002. *(See Van Voris deposition testimony.)*

12.1 Turlock Alternative

Approaches were made to the City of Turlock to ascertain the potential for the discharge of HCC's wastewater to their regional POTW facility on South Walnut Road in Turlock. Carollo Engineering (Turlock's consultant) had determined that the facility had spare capacity to treat some of HCC's waste. On this basis, and a further study by Carollo, HCC proceeded with formal steps to discharge into Turlock's treatment system.

With CVRWCB staff knowledge and acquiescence, HCC planned to pipe wastewater to the Turlock POTW. This pipeline was designed to potentially take HCC's full flow, but the plan was to initially only send up to half of the wastewater. Since the pipeline was to have crossed from Merced to Stanislaus County, discussions with those County officials were also held. A suitable pipeline was designed and the easements obtained along the route chosen. In anticipation of this option, canal crossings were constructed and the whole project was set for a June 2003 start up.

In the meantime, Turlock began to incorporate the potential for more of HCC's wastewater in its upgrade planning. This encompassed the inclusion of HCC's wastewater in their new EIR and capacity expansion plans. A contract was drafted to cover these arrangements.

During this process, in a letter dated February 24, 2003, Turlock advised that the capacity it initially had to process 50% of HCC's wastewater was no longer available. HCC understands that the CVRWQCB had applied more stringent standards to the Turlock facility, which eliminated their previously available capacity and effectively precluded Turlock from taking one-half of HCC's wastewater flow.

Only by building more capacity could Turlock now accommodate any of HCC's wastewater flow. Construction of this added capacity was still some years away from starting, as Turlock had not submitted an EIR for an expansion of the facility to cope with their own growth (outside HCC's requirements). With a long wait for Turlock to build new facilities, HCC was left with no alternative but to "go it alone". The CVRWQCB's tightening of requirements on Turlock, thereby eliminating the Turlock option for HCC, effectively stopped HCC from being in compliance by June 2003 and forced HCC to progress with on-site treatment options as fast as possible.

12.2 The New Approach For On-Site Treatment

Prior to selection of appropriate technologies, HCC undertook a strategic review of environmental issues facing the company and the Central Valley. This review highlighted a number of issues that needed to be included in the future direction of sustainable wastewater treatment. These issues were:

- The increasing use of energy which is in short supply and the majority if which originates from non-renewable sources which add to pollution.
- The semi-arid climate and enclosed basin geomorphology that make the valley a natural salinity accumulator even without human activity. As development of the valley has occurred, salinity issues have arisen requiring salt removal with no practical outlet for the salt.
- The increasing importation of chemicals in treatment processes that add to the salinity burden within the Central Valley.
- The increasing demands being placed on water resources within the valley and the need to reuse water.

Accordingly, HCC developed a strategy for wastewater treatment that would support sustainable wastewater treatment in the Central Valley. The basics strategies were to:

- Reduce reliance on non-renewable energy.
- Reduce chemical use.
- Reduce water consumption
- Utilize treated wastewater for crop irrigation

13.0 The Plan for the New Treatment Process

13.1 Fitting the Technology to the Strategy

A technology search and review conducted by an external consultant (Launch Technologies Ltd) indicated that to fit to the chosen strategies and be able to treat the wastewater the following treatment process would be required:

- Physico-chemical dissolved air floatation to remove suspended solids (PCDAF).

- Anaerobic digestion to convert organics to biogas rather than relying solely on energy intensive activated sludge processes, and utilizing biogas to reduce non-renewable energy use.
- Aerobic polishing to further polish organics and significantly reduce wastewater nitrogen.
- Irrigation of treated wastewater to recycle minerals and water, thereby minimizing the importation of farm macronutrients and extending Central Valley Water supplies.

Reverse Osmosis was not considered, as the membrane processes had proven to be unreliable and environmentally and economically unsustainable. The membrane processes had extensive energy consumption requiring approximately 1 hp per gallon/minute to operate. They required frequent membrane replacements due to heavy and irreversible fouling and scaling problems as compared to other uses. Experience had shown that a membrane life of 4 – 6 months was typical compared to 5 years under seawater desalination processing conditions. Heavy use of cleaning chemicals and antiscalants were required which dramatically increased the total TDS and mineral load to be processed. There were also unresolved technical barriers to processing industrial strength dairy wastewater that hindered progress.

Lastly, once brine was produced there was no local outlet for it. This necessitated that the mineral brine concentrate be exported elsewhere. HCC has been trucking this concentrate to EBMUD's POTW in Oakland. This in turn adds to air pollution and traffic congestion issues due to the number of trucks (10 – 12/day) required to haul the brine long distances.

13.2 **Other Planning Details**

In addition to the selection of the appropriate technologies, a number of other factors had to be considered to ensure the rapid introduction of a new on-site treatment system. Of prime importance was how quickly the project be completed. It was 2002 and the old system was failing at a rapid rate. Many municipal systems under new regulatory requirements have time scales of 5 –7 years to complete their upgrades. HCC felt obliged to shorten that time frame to minimize any impact on the environment and community.

The new system would have to be introduced rapidly so that any discharges were minimized. The aim was to still run as much water through the ROs as possible in trying to comply with the 1997 permit. This meant ensuring that any new equipment was built and commissioned without major interruption to existing treatment capacities.

The VSeps were the major units failing in the early stages of this change. These units removed suspended solids (mainly fats and proteinaceous materials) and were essential to protect the reverse osmosis units from severe organic fouling. The introduction of the PCDAF units were critical to replace the failing VSeps and provide some protection to the existing RO units.

With the introduction of PCDAF, a waste biosolid – DAF Float – would be generated that would require new disposal outlets. In addition, improved outlets were required for the minerals still being extracted from the ROs.

On top of all this, the CVRWQCB staff began to introduce the need to control individual constituents in the discharge, not just the total salinity. For example, in a staff report accompanying a 2003 NOV, Staff introduced a list of potential discharge limits that included sodium at 69 mg/L based on the most restrictive beneficial water use. This was later reproduced in the January 2005 staff report to the CVRWQCB covering the proposed regulation of the food processing industry. This constant change in potential targets being introduced by CVRWQCB staff was tantamount to ”walking standards” which had a strong influence on HCC’s changing design parameters and process selections. Such “walking standards” have repeatedly hampered HCC’s ability to meet the EC specification in its permit since it was issued in 1997.

The result of these factors, and HCC’s desire to try to minimize any environmental impacts, was a need to continue with RO of as much wastewater as possible until alternative mineral outlets could be established.

13.3 **CVRWQCB Staff Support**

CVRWQCB staff has recognized that HCC has attempted to meet the permit conditions it imposed. HCC has supplied the staff with updates on research work and pilot trials throughout the period when the VSEP technology was used. This support included:

- June 15, 2000 – Email from Bert Van Voris to Ken Landau and copied to Loren Harlow – Staff indicated that the problems faced were difficult but Hilmar remained cooperative.
- Fresno CVRWQCB Staff Meeting Notes by Stephen Klein, December 17, 2001 – "Hilmar continues to be cooperative".
- CVRWQCB Executive Officer Letter to Hilmar Cheese, January 2, 2002 – "I was favorably impressed with the efforts Hilmar has undertaken to improve wastewater management practices at the facility" and "I wish to acknowledge the level of effort that you and your staff have expended to bring your waste treatment and disposal operation to its current status."

When the VSEP SYSTEM had to be abandoned, an outline and timeline for the new plan was presented to CVRWQCB staff at a meeting in their offices on March 25, 2003. This meeting included senior HCC staff and the external consultant (Launch Technology Limited). The treatment process was described in terms of using PCDAF, Anaerobic Digestion and Aerobic Polishing prior to discharge.

Immediately following that meeting, CVRWQCB staff forwarded an email to HCC in support of the approach being taken. Included in the email was a suggestion that the mineral issue could be dealt with by mixing the final discharge from the treatment process with TID canal water and distributing this over a large area of land (March 26, 2003 Email from JoAnn Kipps to Warren Climo).

In an NOV sent to HCC in July 2003, CVRWQCB staff withdrew the offer to consider the mineral and water reuse approach initially supported in the March 2003 email, and continued requiring mineral removal and other discharge constraints with an end of pipe limit approach.

In September 2003, in response to the July 2003 NOV, HCC outlined the steps being taken to develop the new treatment system. This included an outline of the process as presented in March 2003, and also included a detailed timeline for completion. No response to the presented plan was ever made by CVRWQCB staff, and this lack of response was taken as acceptance of the plan. HCC proceeded to implement the plan, and eventually met the timeline that had been presented (Letter to CVRWQCB, September 2003).

13.4 Execution of the Plan and Continued Use of RO

- **October 2002:** The first PCDAF unit was installed to replace the failed VSeps. Trials were then conducted to determine how to reduce straggler floc coming from the PCDAF unit and causing excessive fouling on RO membranes.
- **March 2003:** A bank of 8 sand filters was installed to filter PCDAF flow prior to ROs. Although the small pilot trial indicated some improvement would be made, this implementation was R&D at full scale. The improvements were that up to 50% of the TSS was removed through the sand filters, and this helped the processing runtime on the ROs. However, there was still fouling and scaling of the membranes which inevitably led to the creeping failure and ever-declining performance of the RO membranes.
- **July 2003:** A second PCDAF was installed to add additional capacity and provide increased flexibility as the new physico-chemical flocculation conditions were implemented.
- **August 2003:** With some increase in flow through the ROs another secondary RO was installed to further concentrate the retentate from the two large primary ROs.
- **December 2003:** The Biothane EGSB anaerobic digester and biogas scrubber construction was started.
- **April 2004:** The construction of two SBR aerobic polishers and a pre-aeration tank was started.

- **September 2004:** The anaerobic and aerobic systems were jointly commissioned. Following commissioning evaluations were conducted of the issues related to running SBR decants on the ROs. This indicated that severe fouling and scaling continued. This lead to the decision after initial trials to install hollow fiber ultrafiltration units to remove residual organics from the SBR decants.
- **April 2005:** Zenon hollow fiber ultrafiltration systems were commissioned prior to ROs. The ROs were still scaling rapidly so work to alter the level of minerals in the SBR decants was initiated. This involved attempts to precipitate minerals and remove them in the PCDAF and/or the solids from the SBRs.
- **May ’05**: One new primary and one new secondary RO were commissioned but could not be run due a lack of flow through the Zenon units. Changes to the PCDAF and SBR running conditions, made in an attempt to reduce mineral loads, led to poor decants and excessive fouling of the UF membranes.
- **June ’05:** One extra evaporator was commissioned in anticipation of the extra RO concentrate from the new ROs.
- **Current** – R&D to adjust mineral removal processes to allow all ROs to be run.

13.5 Overview of Current System

The current treatment process, as built, is shown and described in a diagram appended to this testimony. Although the difficulties on processing water through the ROs are still present, the evidence of HCC’s efforts in trying to achieve the targets set is obvious. In total, the process includes:

- Three 350,000 gallon equalization tanks
- Two 45,000 gallon dissolved air floatation tanks
- Multiple flocculant and polymer mixing and injection systems
- Three cooling towers and 2 plate and frame heat exchangers
- One 500,000 gallon high rate anaerobic digester

- One 1,000,000 gallon pre-aeration tank
- Two 1,000,000 gallon sequenced batch aerobic reactors
- One 1,000,000 gallon surge tank
- One 1000 gallon per minute hollow fiber UF
- One 500 gallon per minute hollow fiber UF
- Three 640 gallon per minute cross flow primary ROs
- Two 220 gallon per minute cross flow secondary ROs
- Two 80 gallon per minute evaporators
- Multiple ancillary tanks, pumps etc
- Two 20 million gallon RO permeate storage ponds
- Irrigation distribution systems

13.6 **Voluntary Clean Up and Mitigation Measures**

HCC has undertaken an extensive program to mitigate any effects its discharge may have had on the environment. To reduce odors and flies in the surrounding fields, the company has employed a range of activities. An external spraying program to control flies has been in place since September 2000. A formal monitoring program to support the spraying was started in June 2002. Thereafter, to ensure aeration of the primary fields and to further reduce odors and flies, the primary fields have been cultivated within a few days after irrigation. This breaks up the fly breeding cycle and maintains aerated fields to reduce the potential for odors. Bottled water also has been provided, upon request, to concerned residents within the vicinity of the site. Currently, HCC is supplying bottled water to six residences.

13.7 **Cooperation and Actions for Issued NOVs**

Several NOVs have been issued against HCC for various reasons. In each case, HCC responded in a timely, positive and cooperative manner. The company has implemented a range of changes at considerable expense to accommodate the wishes of the CVRWQCB staff. These changes have included increasing sampling and testing regimes, modifying plant equipment and processes, and changing reporting methods – all at considerable cost.

One such issue was the CVRWQCB staff concerns over the tile drainage system and the potential for HCC discharges to enter the drain and be transported to TID's lateral No. 6. To remove the potential for this to happen, HCC voluntarily closed the drain that was located on the Gemperle area prior to distributing wastewater to it on September 27, 2000. To further address the staff's concerns in this regard, HCC submitted a tile drain work plan to install a manhole at the corner of August Avenue and Oslo Road to intercept the tile drain header and install an in-line flow meter. The work plan was approved on February 20, 2001, and the manhole was installed on March 8, 2001. A sampling regime was then started. No flow was recorded on the meter and multiple physical observations in the manhole all showed an absence of water flow. HCC had the meter calibrated and checked in March 2002 at the suggestion of CVRWQCB staff. When the flows still did not show, the drain line was closed in January 2003 above the flow meter. After additional concerns were raised, on November 14, 2003, the drain was exposed further up the line (southern end of Nyman's fields) and closed off again. This procedure was documented with photographs sent to CVRWQCB staff, which showed that the drain was blocked with sediment and very likely had not flowed for a considerable period of time.

13.8 **Discharge and Effects**

The company has closely monitored the effects of the wastewater discharges on the primary fields. The testing and monitoring reports are extensive and are a matter of record. From a practical point of view there are a number of issues that should be explained.

Firstly, land based treatment of food processing wastes is an EPA recognized treatment system. The primary fields have received the organic and mineral loads since 1985. Land areas have been increased as the plant expanded. Crops have been grown to remove nutrients that have accumulated in the soil. The organic load has aided in the denitrification of nitrate in the soil to such an extent that the area under, and in close proximity to, the primary fields has significantly lower groundwater nitrate levels than ambient groundwaters outside of this area.

This is a very positive effect on shallow groundwater quality in terms of human health that would not have occurred without HCC's discharge.

Secondly, HCC recognized that during the summer of 2002, when the VSeps failed and treatment levels dropped dramatically, that the primary fields contributed to an odor problem. A public meeting was held to explain the issues with the local community and actions were taken by HCC to rectify the situation (including the actions discussed above). The primary focus to eliminate this problem was to reduce the organic loads, particularly fats, from the discharges to the primary fields. This was successfully done with the installation of the DAF systems in October 2002 and has continued to this day.

Thirdly, the main constituents that are not removed or absorbed by the soil treatment systems are sodium and chloride. These constituents are not subject to primary water quality standards (for drinking water). No restrictions to growth have been observed in the primary fields, when they have been cropped, indicating that the soils are in good health.

Lastly, the actual volume of minerals discharged to the primary fields in excess of the 900 µmhos/cm EC limit and contained in the 821,000,000 gallons reported in the ACL Staff Report can be estimated as follows:

- Assuming average mineral densities of 2.5 g/ml
- 900 µmhos/cm EC limit is equivalent to 585 mg/L as TDS
- Average TDS level discharge over the 585 mg/L TDS limit is 1204 mg/L

Then

- Weight of excess minerals discharged in 821,000,000 gallons is 3.74×10^9 g
- @ 2.5 g/ml density this weight of minerals would occupy a volume of 1,496,000 liters or 395,394 gallons.

Many of these minerals would have been incorporated into the soil matrix (absorbed onto soil particles and into soil organic matter). Others would have been taken up in the crops that were grown while others, as indicated in monitoring and groundwater reports, have infiltrated the shallow groundwaters.

For those minerals that have migrated into the shallow groundwater, HCC has been complying with the conditions of the CVRWQCB's Cleanup and Abatement Order issued in December 2004. This has included sampling of all the wells within a ½ mile radius of the primary fields (completed) and a large groundwater study for which a plan was submitted in March 2005 (but as to which HCC is still awaiting a response from CVRWQCB staff in order to proceed).

14.0 Extensive R&D Undertaken

From its initial forays into mineral removal in 1996 up to the present day, HCC has undertaken an extensive amount of R&D. At the beginning of this period, no operational systems using membranes to remove minerals on industrial strength dairy wastewater were in existence. There were no guidelines or design parameters that could be used to ensure success of such a system nor were there any implementation plans associated with the Basin Plan from which guidance could be drawn. Best practicable treatment and/or control practices also had not been established for these mineral removal processes on industrial wastewater.

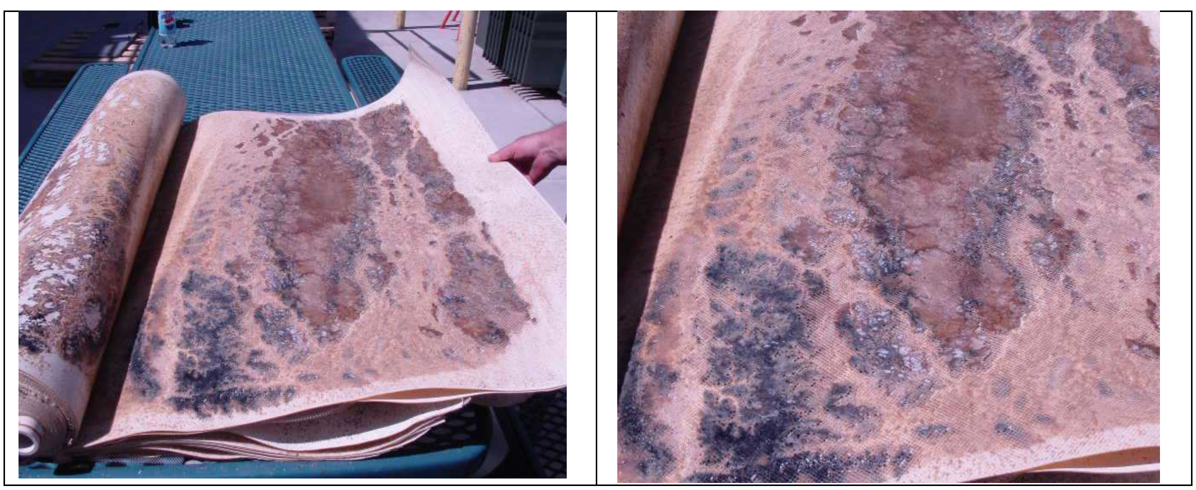
Effectively, HCC was required by the CVRWQCB to be a *de facto* full-scale environmental engineering test case. This approach was, and still is, unprecedented. Prior to HCC's requirements, only municipalities had been asked to look at mineral discharges and they began at concentrations an order of magnitude lower than HCC's and nowhere near the concentration of the troublesome scaling compounds.

To our knowledge, the only facilities that were using RO for mineral removal were desalination plants and these were being run on a completely different basis than HCC's wastewater treatment. In desalination, the easiest energy-efficient fraction of saline water is recovered for the purposes of generating high quality water. The slightly increased salinity reject is normally by-passed to the original saline source (e.g. the ocean). In these circumstances, there is an almost infinite outlet for brine and it is not normally restricted by the receiving water. This means that the ROs can be set up to make clean water without regard for having to concentrate the removed minerals. Under these conditions, very little concentration is required (typically 1 gallon of retentate for every two gallons of salt water feed), and the membranes require very little cleaning (2 –3 months between cleans) and 5 year life cycles can be achieved before replacement.

In contrast, HCC has had to take all of its wastewater through the membrane processes to concentrate almost all of the salts. This requires a high level of concentration through the processes, 10 times greater than desalination, which causes a huge propensity to precipitate minerals and hence scaling. On top of that, there is a need to find brine disposal opportunities. These opportunities are not readily available locally nor are they easily developed. Even the State of California, having known about this salinity disposal problem for at least 50 years, has still not proffered a practical solution for any dischargers in the Central Valley.

For HCC's system, where the removed minerals had to be concentrated and trucked off site, membrane life is only up to 4 – 6 months with a replacement cost of $862,400 per change for all the RO systems. In addition, daily cleaning is required which increases the consumption of chemicals and decreases capacity by approximately 20% due to the downtime alone. Even with this level of cleaning, severe fouling and scaling is evident (see Figure 3 below).

Figure 3: Scaling of HCC's RO membranes after two months of use.



All of this means that there is still a very large on-going R&D project at HCC to try to decrease fouling and scaling on the ROs and evaporators while trying to remove almost all of the minerals and concentrating them beyond their solubility products. For example, in trying to run

SBR decants on the ROs by reducing mineral loads, many types of mineral precipitation processes have been tried by HCC with limited success at this stage of development. These physico-chemical processes have caused problems with preceding environmental engineering unit operations. Specifically, there is preliminary evidence that the addition of chemicals to remove minerals has caused problems with potential biological toxicity and physiology of the biological treatment systems. This, in turn, had an apparent flow-on effect with fouling of the Zenon UF systems that were installed to protect the ROs from microbial fouling. There is too little known about the interactions of all these environmental engineering unit operations. HCC's experience under full-scale R&D is that RO cannot be considered acceptable, reliable technology for dairy industry wastewater treatment. Future R&D work is beyond HCC's individual capacity and should be undertaken by a collaborative effort with academics, technologists, industry groups and regulators.

15.0 Other Issues for Reverse Osmosis in Wastewater Treatment

When RO is used to remove minerals, concentrated brine is produced that requires disposal. For the Central Valley, the only current disposal for the brine is to truck it to a POTW that discharges minerals to the ocean. This process contributes to a raft of other potential environmental problems. The trucks use non-renewable energy and contribute to air pollution. In addition they add to traffic congestion that in turn leads to inefficient energy consumption and more pollution. Consideration of these factors under a full review of the Basin Plan or an implementation plan for the Basin Plan, best practicable treatment and/or control practices and potential permit limits has not been completed to our knowledge.

Deep well injection of minerals is being explored by HCC as an alternative to trucking them out of the valley. This involves injection to approximately 3300 – 4000 ft below the surface to under an impervious layer of shale. A permit is being sought from EPA for this. However, even with a permit, there is no guarantee that this will be a viable outlet until a test well is drilled and the injection process researched.

The option to spread beneficial minerals back onto the land needs to be explored further. The CVRWQCB staff's apparent drive to stop all land-based treatment and disposal of wastes is depriving the Central Valley of the potential to lower the importation of agricultural minerals and reuse water. By not permitting the reapplication of beneficial minerals from the valley, farmers have no choice but to import fertilizer to replace the same nutrients. In addition, by maintaining a singular focus on restricting discharges on the basis of EC, alternative cleaning chemicals, which contain more agriculturally beneficial minerals (e.g. potassium hydroxide), cannot be used.

Given the predicted future shortage of water in the valley, all options to reuse water should be explored. In terms of treatment, RWQCB staff in other regions have recognized that mineral (salt) removal from wastewater is not viable. **"***There is no treatment technology that's economically feasible to remove salts from the wastewater. Our general order focuses on source control … [and] is designed to encourage wineries to recycle wastewater into the largest area possible to spread out the water and prevent localized impacts to water.***"** *Harvey Packard, Central Coast RWQCB, at SWRCB Workshop, July 11, 2005.*

16.0 LIST OF REFERENCED DOCUMENTS

1. April 2000 CVRWQCB Letter from Doug Patterson on organic limitations

2. March 2003 email from Jo Anne Kipps on meeting in Fresno

3. September 2003 second response to July 2003 NOV

    3a. Figure 1

    3b. Figure 2

4. 1994 Nolte technology study

5. 10/31/00 RWQCB letter about designated waste

6. 3/20/01 NOV relating to designated wastes

7. Draft contract with City of Turlock for wastewater treatment

8. 2/24/03 City of Turlock letter backing out of treatment

9. 2002 Launch Technology Review

    9a. Figure 2

    9b. Page 24

    9c. Figure 3

10. January 2005 Staff Submission to CVRWQCB on regulation of food processing wastewater

11. 6/15/00 - email from Bert Van Voris

12. 12/17/01 - S Klein notes of meeting with Hilmar Cheese Company

13. Overview diagram of HCC's current treatment process

14. 2/15/01 tile drain work plan

15. 2/20/01 RWQCB approval of tile drain work plan

16. 11/18/03 closure of tile drain

    16a. Photos